Remarks

In view of the foregoing amendments and these accompanying remarks, it is respectfully requested that this application be reconsidered.

Claim 28 has been amended in order to more particularly point out and distinctly claim the scope of the invention. In so doing it is believed that the rejection under 35 USC 132 has been obviated and it is requested that that the rejection be withdrawn.

Applicant has considered the prior art rejections and respectfully disagrees with the Examiner. Reference is made to the accompanying Declaration of Doron Spitz and Vladimir Kliatzkin. From these reported test results, it is apparent that the herein claimed invention has substantial benefits over the prior art batteries.

At the outset, it should be clarified that the invention refers to a rechargeable, secondary battery of Silver-Zinc system, which utilizes flexible electrodes made out of compacted powder the particles of which are not sintered, nor bound or glued therebetween. The active material is compacted to the required porosity, which is defined in the application. The electrodes are wrapped up in flexible separators, which insulate the electrodes one from another. The active materials of the electrodes are Zn oxide and Ag (when the battery discharges). The substrates could be made out of a metallic grid or made out of woven conductive fabric. The electrodes are installed in a casing (as they can not stand alone because they will dissipate) filled with an electrolyte, the ions of which can diffuse through the pores of the separator to approach the particles of the active material and thus enabling the electrochemical reaction to take place during charging and discharging of the cell. The electrodes can be in a flat or spiral (wound up) configuration. One of the most important features of the invention is using a means for applying pressure on the electrodes, normal to its plane.. In one embodiment a spring, pressing on the electrodes is employed as such a means. The pressure is required in order to maintain the physical contact between the particles of the active materials themselves and also between the particles and the substrate. This pressure is necessary in order to avoid possible change of volume of the active material caused by the change of its density (bulk & absolute) during the electrochemical

reaction. Due to this change of the volume there is a danger that the structural integrity of the electrodes will be deteriorated and as a result the electronic conductivity will be reduced, as well as the cell's efficiency. The present invention seeks to compensate for these volume changes by applying pressure to the electrodes and thus to counteract the electrode's volume changes. The means for applying pressure can be not only a dedicated spring fixed to the casing and capable of pressing the walls (as seen in Fig.1). It can be also the elasticity of the casing itself, which would act on the electrodes, if they were densely packed within the casing (this is applicable also to spirally wound electrodes as shown in Fig.3). Furthermore, in one of the embodiments the separator can be made of material, which when immersed in the electrolyte swallows during the functioning of the cell, and this can also cause pressure on the particles of the active material and thus to contribute to the desired effect, i.e. to the counteracting to the electrode's volume changes.

It might be true that nowhere in the specification as filed or as amended is there an explicit indication that the pressure is applied in a direction substantially perpendicular to the electrodes. It is believed, however, that this is implicit from the description of the spring, etc. As mentioned above and in the Specification, the present invention seeks to compensate for volume changes by intentionally applying pressure to the electrodes and thus to counteract the electrode's volume changes. It may be concluded that the pressure has to be applied perpendicularly to the electrodes in order to achieve this desired effect. Therefore, as previously presented Claim 28 did not contain new matter and was supported by the Specification. Nonetheless, the language of Claim 28 is now amended to delete reference to the direction of the pressure and to instead mention that the pressure is applied to counteract the electrode's volume changes. This amendment is fully supported by the specification as filed, see for example page 3, lines 21-23, page 4, lines 4-8 or by amendment dated September 13, 2004 to the Specification pages 4, line 15 and page10, lines 4 and 21.

Honda (US Patent 5,580,676) discloses a Li-ion or Li-polymer system, which employs rigid electrodes. In this system the electrodes do not change their volume due to electrochemical reaction. Therefore, there is no need for any means for counteracting to such changes and for

applying pressure on the electrodes. Honda does not teach or even suggest that pressure is applied to the electrodes. To the contrary, external pressure is not required and is not applied. Honda does not have any explicit or implicit indication that external pressure is applied to the electrodes. Therefore, it cannot anticipate or obviate the instant invention.

As taught by Honda, the electrode groups are formed by "packing each of plural cathode plates with a separator 4 as a sheet ... inserting anode plates 5 ..." (Column 3, lines 56- 62). In contradistinction, the herein claimed and described cell has "flat electrodes encased in said housing and immersed within an electrolyte, at least one of said electrodes including an electrically conductive substrate and compressed particles of an active material deployed on said substrate." Therefore, Honda is not at all applicable as he uses an entirely different type of electrode.

Regarding Claims 36,42-45, Honda discloses a system, in which is employed either a polypropylene or a polyethylene separator. It is well-established fact that these materials do not swallow when immersed in electrolyte and therefore a separator made of these materials is not able to apply pressure on electrodes. Applicant cites in this connection US Patent 6372379, in which is described a micro porous separator for Ag-Zn batteries. This separator is made of a polyolefin polymer. It is explicitly stated in example 6 that this separator does not swell in KOH.

In contrast to the cellophane separators which swells and acts as a spring, (as in the present invention), the polyolefin polymer separator employed in Honda does not swell (as known in the art and as for example shown in US Patent 6372379).

Regarding Claim 41 there is no disclosure or suggestion in Honda that the battery casing 2 is elastic and that it is designed for and is capable of applying pressure on the electrodes.

Claim 34 depends on claim 28 and claim 28 now explicitly indicates how the pressure is applied. The manner in which pressure is applied in the present invention has nothing to do with the

manner of applying pressure in Pyszcek (US Patent 5,756,229). The purpose of applying pressure in Pyszcek is to prevent axial displacement of the wound electrode assembly, which might be caused by a shock. Pyszcek employs for this purpose resilient elements 52 placed between separator assembly 30 and upper and lower end walls 16 and 18. These elements comprise wave springs, which are selected intentionally to resiliently dissipate (to shock absorb) mechanical forces acting to otherwise cause axially movement of the spirally wound assembly 30. In other words, the pressure means of Pyszcek is intended to exert pressure along the longitudinal axis of the battery. Due to this axial direction pressure will not bring the particles of active material in contact as required for counteracting the electrode's volume changes. Thus Pyszcek would not meet the requirement of reasonable expectation of success.

As explained by Pyszczek "Being spirally-wound, anchoring of the electrode and separator assembly 30 may be limited to the periphery thereof. Thus the central portion of the assembly 30 may tend to telescope outwardly under mechanical shocks and be damaged. In order to prevent this from occurring, in accordance with the present invention a resilient member is disposed between the assembly 30 and at least one but preferably each of the end walls 16 and 18 for resiliently dissipating (shock absorbing mechanical forces ..." (Column 2, line 59 – Column 3, line 3). In contradistinction, the herein invention discloses and claims a "means for applying pressure on said electrodes so as to counteract the electrode's volume charges resulting from electrochemical reaction between the electrolyte and the active material." Whereas Pyszcek is concerned with the assembly unwinding due to a mechanical shock, Applicant is concerned about overcoming the volume changes of the active materials induced by the electrochemical reaction.

Furthermore, Pyszcek is not combinable with Honda, since Honda discloses a cell with flat, rigid electrodes, while Pyszcek describes a cell with flexible, wound electrodes. Further, even taken together, as explained above, the individual references do not disclose or suggest some of the salient

elements of the inventions, so certainly a combination of them would still be lacking these claimed elements of the instant invention.

There is no evidence that the references contain some teaching, suggestion or motivation to combine them. On the contrary, the cited references refer to different types of electrodes (Honda to rigid electrodes and Pyszcek to flexible electrodes) and therefore one skilled in the art would not consider their teachings combinable. Furthermore, neither Honda nor Peszezel deal with the problem of counteracting the volume changes of the electrodes caused by the electrochemical reactions of the active materials and therefore they do not address the same problem as the present invention.

The resilient element of Pyszcek does not indirectly exert pressure to the electrode in a perpendicular direction. Instead, in Pyszcek this resilient element assists to maintain structural rigidity of the cell, in order to avoid its deterioration, which might be caused by a mechanical shock. Pyszcek does not contain any implicit or explicit indication that this resilient element is designed for or is capable of maintaining contact between particles of active material, so as to counteract the volume changes of electrodes due to electrochemical reaction.

Claim 35 is dependent from claim 28. As just stated above the means for applying pressure employed in Pyszcek is devoted for a different purpose and is designed differently than the herein claimed invention. It is not clear why and in which connection Takamura (US Patent 4,407,907) is cited in the end of item 5 on page 8 of the Office Action.

Claims 29, 30 and 32 are dependent on claim 28. Schulze (US Patent 5,993,618) employs woven carbon fiber with a thickness of 0.36 mm. In the present invention, the substrate is made of carbon fabric with a thickness of 0.01-0.1 mm. It is not clear how the thickness of the fabric in Schulze anticipates the present invention. Schulze employs finished catalyzed electrodes with a thickness of

0.4-0.5 mm (Column 7, lines 14- 23) and does not mention a finished catalyzed electrode with a thickness ranging from 0.04 to 0.14 mm. In the present invention the thickness of each electrode is 0.8-10 mm. Therefore, the thickness of electrodes in Schulze does not anticipate or obviate the present invention.

Claim 31 also depends on claim 28. Aihara (US Publication 2003/0170536) describes a battery, which is designed differently form the present invention. Aihara does not employ flexible electrodes. In Aihara l. the electrodes are directly bonded to a common adhesive resin layer, which separates between them. The electrodes and the separator constitute an integral, rigid body. In Honda electrodes are separated one from another by respective separators and electrodes are not united in an integral rigid body. Therefore Honda and Aihara are not combinable in principle not to mention the fact that neither Aihara nor Honda contains any explicit indication about the desirability of such a combination. As to Aihara reference, the Applicant contends that it is irrelevant to the present invention, since it does not refer to a cell with a flexible electrodes (as the present invention). Merely the statement that electrodes of Aihara can be Ag-Zn electrodes is insufficient for obviating the present cell, which is defined by the particular design claimed in claim 28. None of the features found in this claim are present in Aihara.

Claim 33 is also dependent on claim 28. The sintered powder material mentioned in Column 1, lines 20 -30, of Takamura has nothing to do with the active material employed in the present invention. The sintered powder material of Takamura (mentioned at Column 1, lines 20-30) is not active material, which participates in the electrochemical reaction, but organic (filling) material, which is intended for increasing porosity of the electrodes. This material is not intended for or capable of participating in the electrochemical reaction.

Claims 38 and 46 are both dependent claims. Claim 38 refers to material of the substrate, which is made of woven carbon fabric, which fibers are coated by a metal coating. Takamura (Col.1, lines 48-

55) refers not to a substrate, but to active material of the electrode, which is made either of active carbon powder carrying a catalyst coated by metal or is made from a non woven fabric, which is not coated. Takamura does not anticipate the substrate material of the present invention. Claim 46 of the present invention refers to active material of the electrodes. This material is carbon or Silver and it does not carry a catalyst (as in Takamura).

Claims 39 and 40 are both dependent claims, and refer to metallic coating on carbon fibers of a woven fabric of the substrate. Faris (US Publication 2003/0143446) discloses a metallic coating on a back layer of low-density plastic material. This coating is integral with the plastic layer and functions as active material of the electrode. In the present invention, the active material is granular powder, which is not integral with the substrate. In the present invention, the substrate is not a rigid plastic layer, but flexible woven carbon fabric, the fibers of which are coated by metallic coating. Thus, Faris is believed to not be applicable at all.

Therefore, the claims are novel over the cited prior art and not anticipated or obviated, and the rejections under 35 USC 103 should be withdrawn.

It is, therefore, requested that a Notice of Allowance issue and that all of the pending claims be allowed.

Dated: July 25, 2005

Respectfully submitted,
Lilling & Lilling P.C.
Customer No. 24101

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Bruce@Lilling.com

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TECHNION RESEARCH AND DEVELOPMENT FOUNDATION LTD.

מכון המתכות הישראלי
ISRAEL INSTITUTE OF METALS

September 19, 2000

To: Dr. V. Kliazkin
Unibatt

Test of Rechargeable Batteries- Product of Unibatt

This letter is to confirm that we have tested the examples of rechargeable batteries as you requested. The repetitive charge-discharge cycles have been provided in accordance with technical specifications for voltage limits specified by Unibatt. The tests have been done for products named F 2.2 F and F2.2 P.

Herewith, please find attached data received in these tests and the technical explanations regarding the tests.

Sincerely yours,

Dr. G. Frant, El. Eng.
Grigory Frant

D. Spitz
Director

מוסד הטכניון למחקר ופתוח בע"מ
חיפה
מכון המתכות הישראלי
HAIFA
Technion Research & Development Foundation Ltd.

Test of UniBat Rechargeable Battery (#54)

Product designation:

Product name	F2.2 P
Sample number	54
Kind of Layout	Prismatic
Dimensions	48x17x8.6 mm
Weight	18g
Declared parameters:	
Capacity	2.2Ah
Discharge Current	0.15A
Charge Current	0.05A

Test procedure:

The Charge –Discharge cycle was conducted by use of Computer Controlled System in the following mode:

Charge:

Kind	Constant current
Rate	0.05A
Cutoff voltage	2.05V

Discharge:

Kind	Constant load
Rate	10.0hm
Averaged current	0.15A
Cutoff voltage	1.0V

The apparatus:

Data acquisition PC based system and 8 – channels power supply designed specially for battery testing.

Test - bench:

Voltage, current and time in the test process were measured and recorded on PC. This system was proposed and checked by Technion Foundation for Research and Development . The software algorithm is based on DasyLab 5 acquisition program.

Test results:

Typical Discharge – Charge curve is presented in Fig1, Capacity curve is shown in Fig 2.

Cell cycled 30 cycles.

Battery's appearance is given in Fig. 3

Test of UniBat Rechargeable Battery (#55)

Product designation:

Product name	F2.2 P
Sample number	55
Kind of Layout	Prismatic
Dimensions	48x17x8.6 mm
Weight	18g
Declared parameters:	
Capacity	2.2Ah
Discharge Current	0.15A
Charge Current	0.05A

Test procedure:

The Charge –Discharge cycle was conducted by use of Computer Controlled System in the following mode:

Charge:

Kind	Constant current
Rate	0.05A
Cutoff voltage	2.05V

Discharge:

Kind	Constant load
Rate	10.Ohm
Averaged current	0.15A
Cutoff voltage	1.0V

The apparatus:

Data acquisition PC based system and 8 – channels power supply designed specially for battery testing.

Test - bench:

Voltage, current and time in the test process were measured and recorded on PC. This system was proposed and checked by Technion Foundation for Research and Development. The software algorithm is based on DasyLab 5 acquisition program.

Test results:

Typical Discharge – Charge curve is presented in Fig.4. Capacity curve is shown in Fig .5.

Cell failed during 27 cycle.

Battery's appearance is given in Fig.6

Test of UniBat Rechargeable Battery (#59)

Product designation:

Product name	F2.2 F
Sample number	59
Kind of Layout	Flat
Dimensions	48x34x4.3 mm
Weight	18g
Declared parameters:	
Capacity	2.2Ah
Discharge Current	0.15A
Charge Current	0.05A

Test procedure:
The Charge –Discharge cycle was conducted by use of Computer Controlled System in the following mode:

Charge:

Kind	Constant current
Rate	0.05A
Cutoff voltage	2.05V

Discharge:

Kind	Constant load
Rate	10.Ohm
Averaged current	0.15A
Cutoff voltage	1.0V

The apparatus:
Data acquisition PC based system and 8 – channels power supply designed specially for battery testing.

Test - bench:
Voltage, current and time in the test process were measured and recorded on PC. This system was proposed and checked by Technion Foundation for Research and Development. The software algorithm is based on DasyLab 5 acquisition program.

Test results:
Typical Discharge – Charge curve is presented in Fig.7, Capacity curve is shown in Fig .8.
Cell failed after 23 cycles.
Battery's appearance is given in Fig.9

Test of UniBat Rechargeable Battery (#62)

Product designation:

Product name	F2.2 F
Sample number	62
Kind of Layout	Flat
Dimensions	48x34x4.3 mm
Weight	18g
Declared parameters:	
Capacity	2.2Ah
Discharge Current	0.15A
Charge Current	0.05A

Test procedure:

The Charge –Discharge cycle was conducted by use of Computer Controlled System in the following mode:

Charge:

Kind	Constant current
Rate	0.05A
Cutoff voltage	2.05V

Discharge:

Kind	Constant load
Rate	10.Ohm
Averaged current	0.15A
Cutoff voltage	1.0V

The apparatus:

Data acquisition PC based system and 8 – channels power supply designed specially for battery testing.

Test - bench:

Voltage, current and time in the test process were measured and recorded on PC. This system was proposed and checked by Technion Foundation for Research and Development . The software algorithm is based on DasyLab 5 acquisition program.

Test results:

Typical Discharge – Charge curve is presented in Fig.10, Capacity curve is shown in Fig. 11.

Cell failed after 32 cycles.

Battery's appearance is given in Fig.12.

Fig. 1 file: b54_004

4/10/00 - 4/12/00

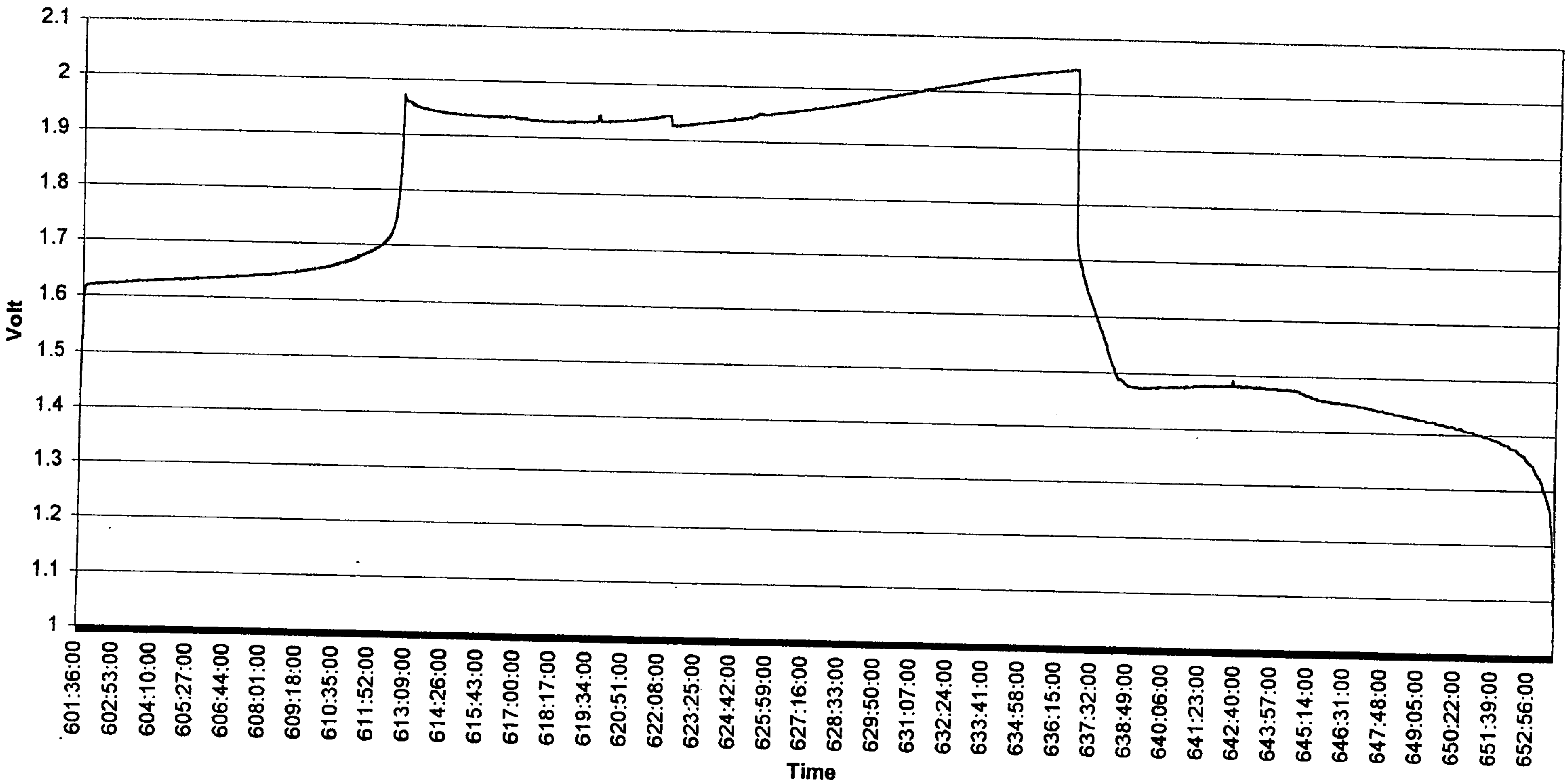


Fig. 2

file: b54_004
4/10/00 - 4/12/00

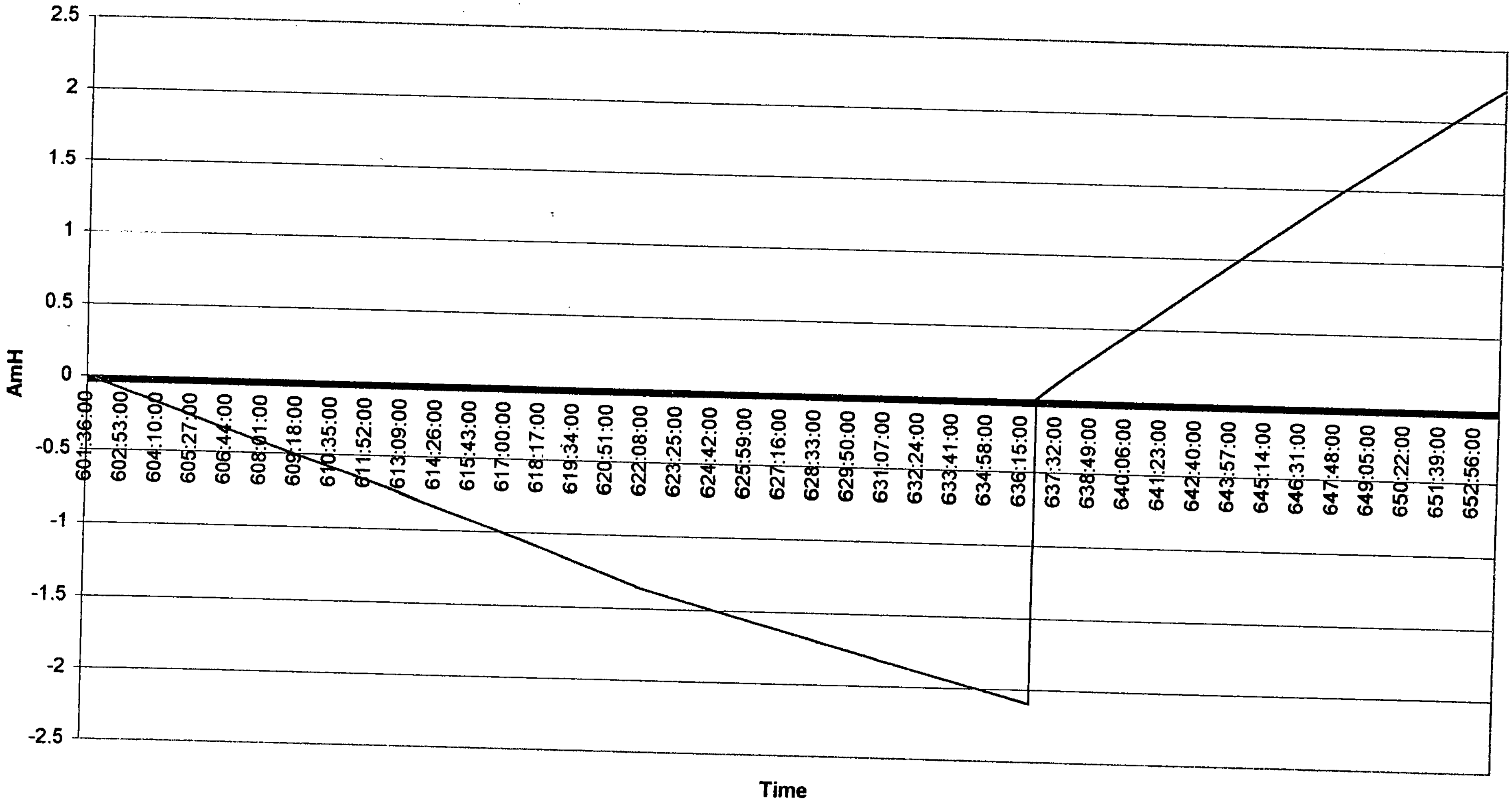


Fig. 3

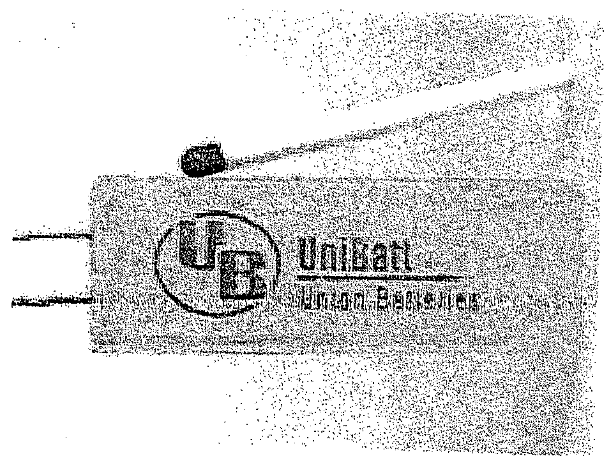


Fig. 4

file: b55_012
5/8/00 - 5/11/00

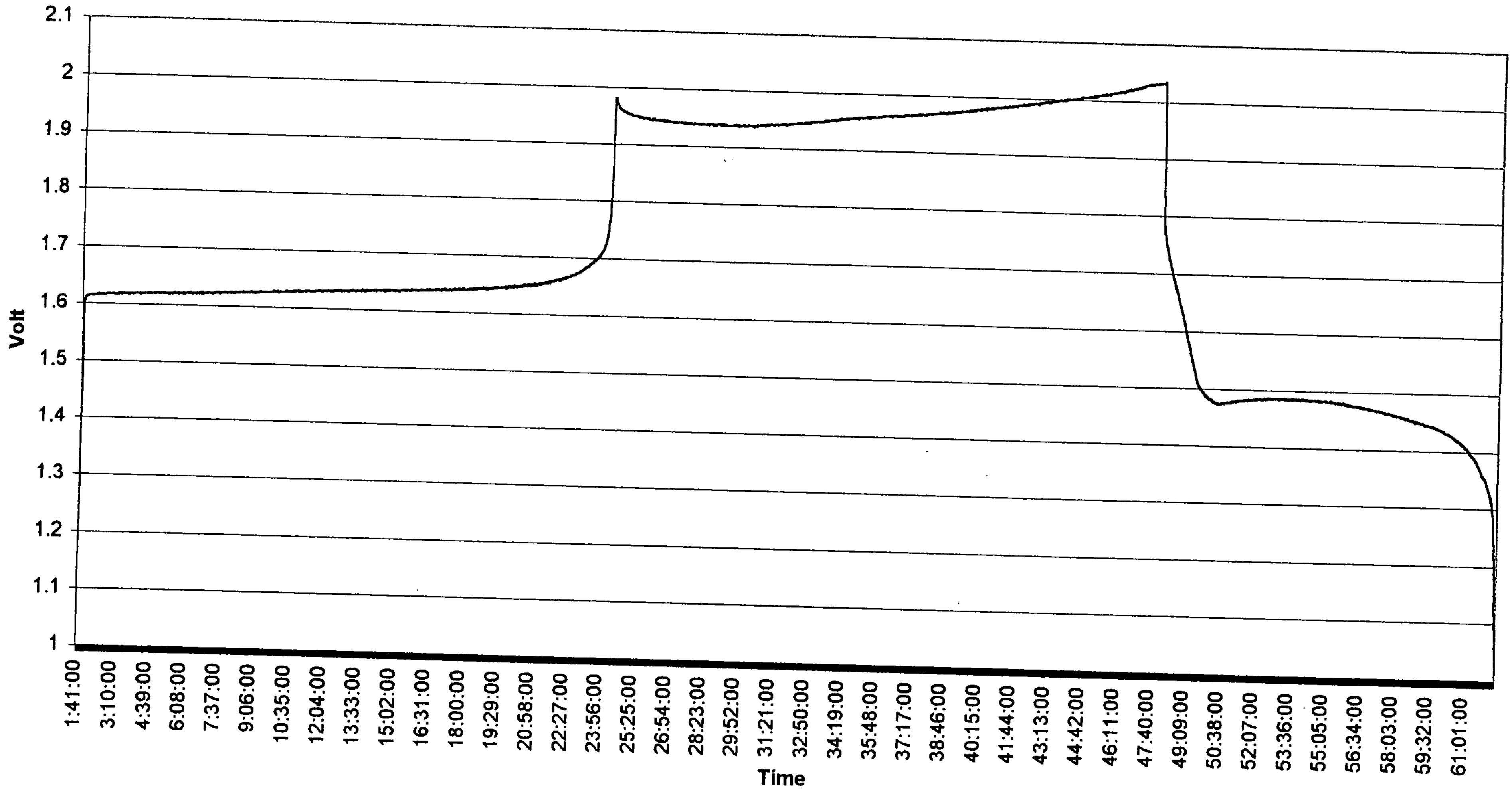


Fig. 5 file: b55_012
5/8/00 - 5/11/00

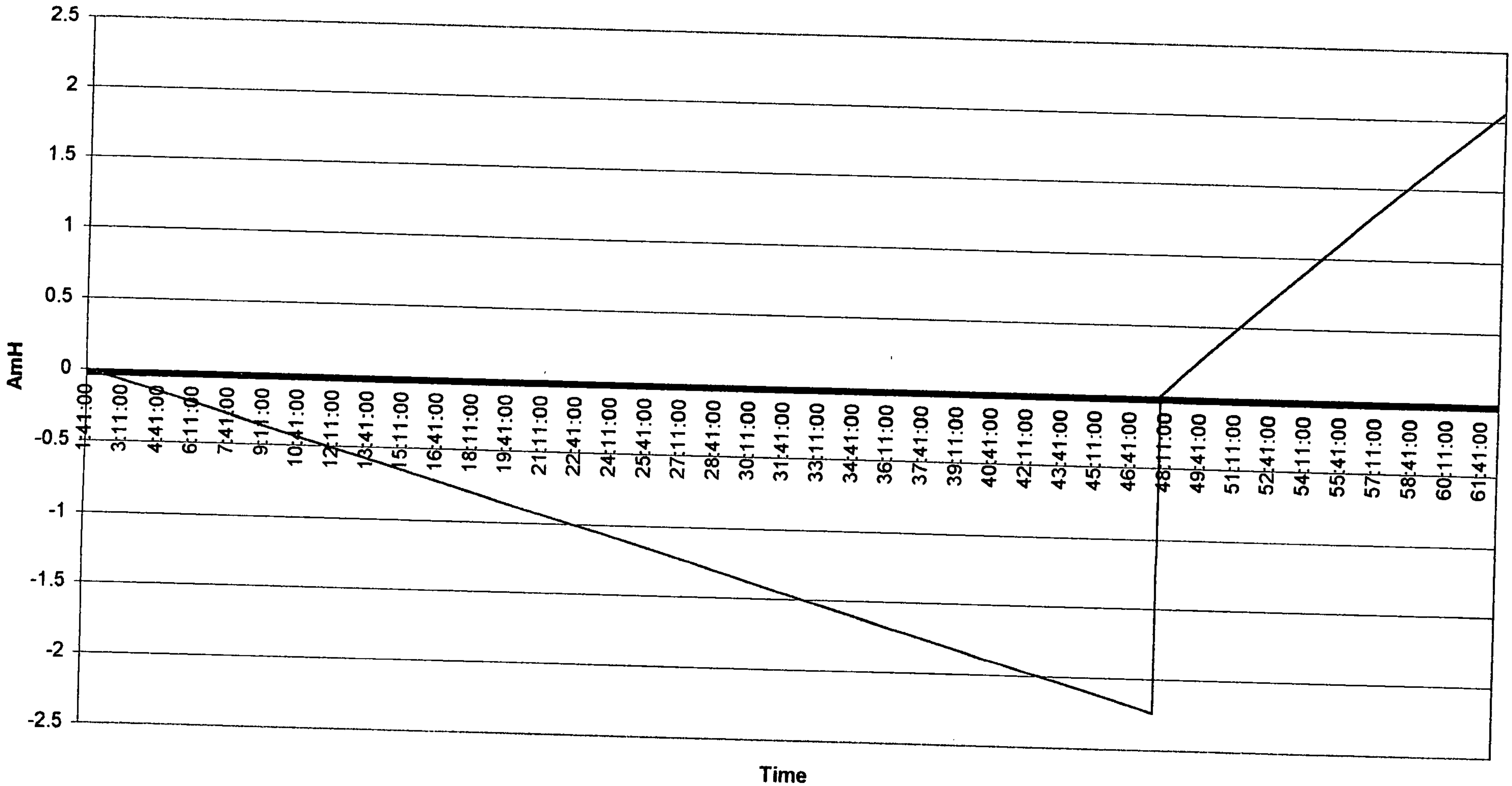


Fig.6

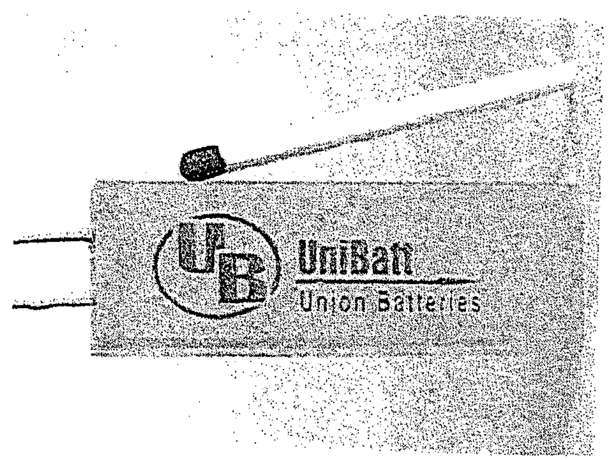
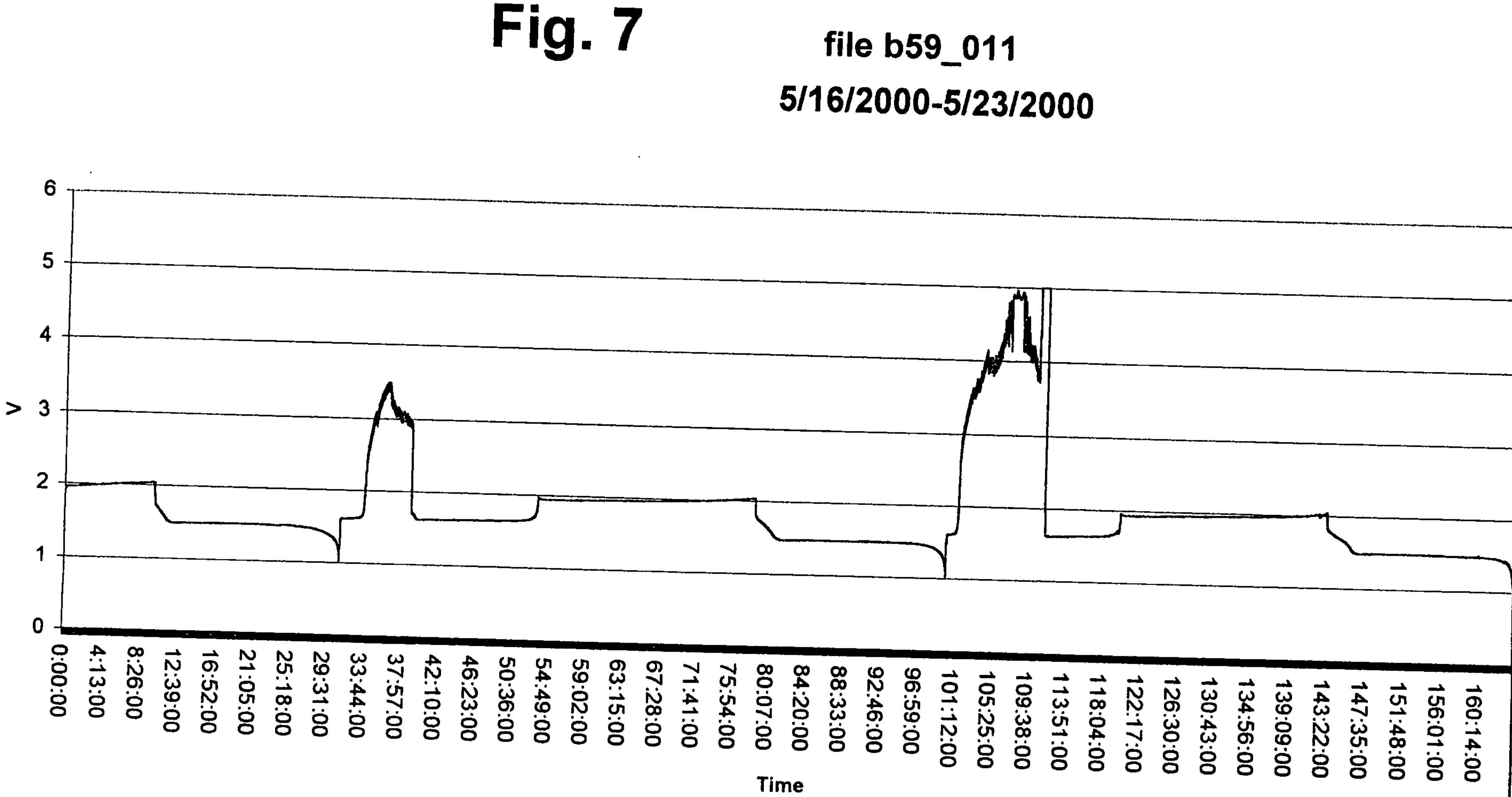


Fig. 7


file b59_011
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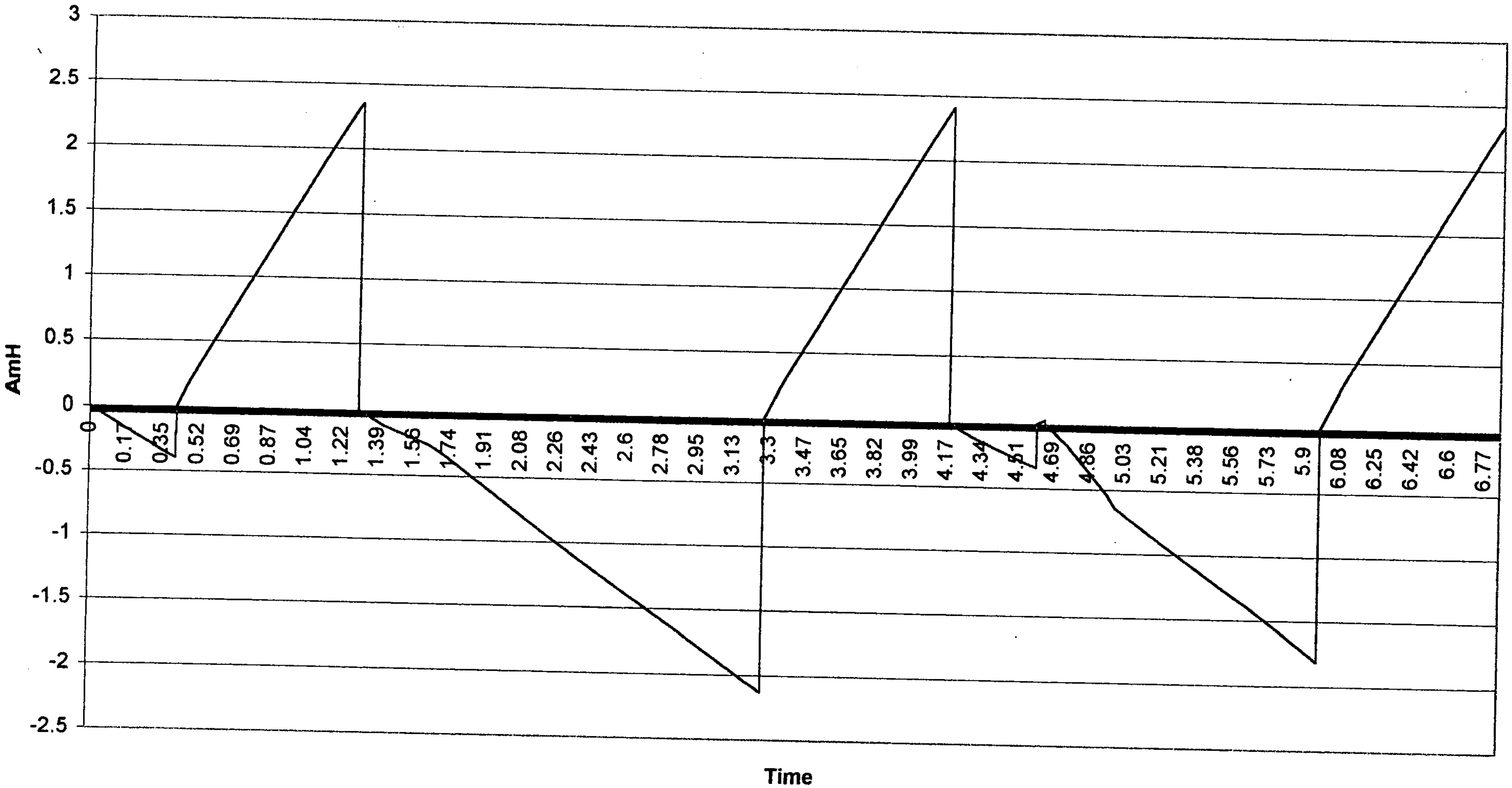
88:33:00
92:46:00
96:59:00
101:12:00
105:25:00
109:38:00
113:51:00
118:04:00
122:17:00
126:30:00
130:43:00
134:56:00
139:09:00
143:22:00
147:35:00
151:48:00
156:01:00
160:14:00
Time

Fig. 8

file: b59_011
5/16/00 - 5/23/00



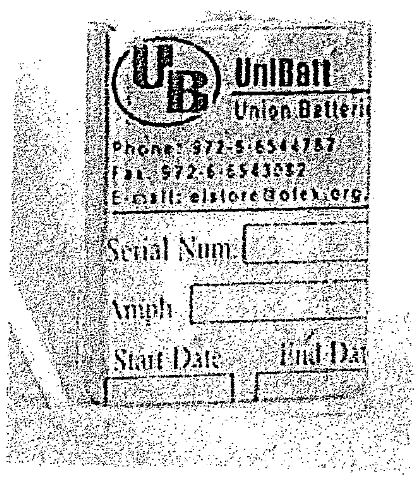


Fig. 9

Fig. 10 Voltage b62-08
07/06/00

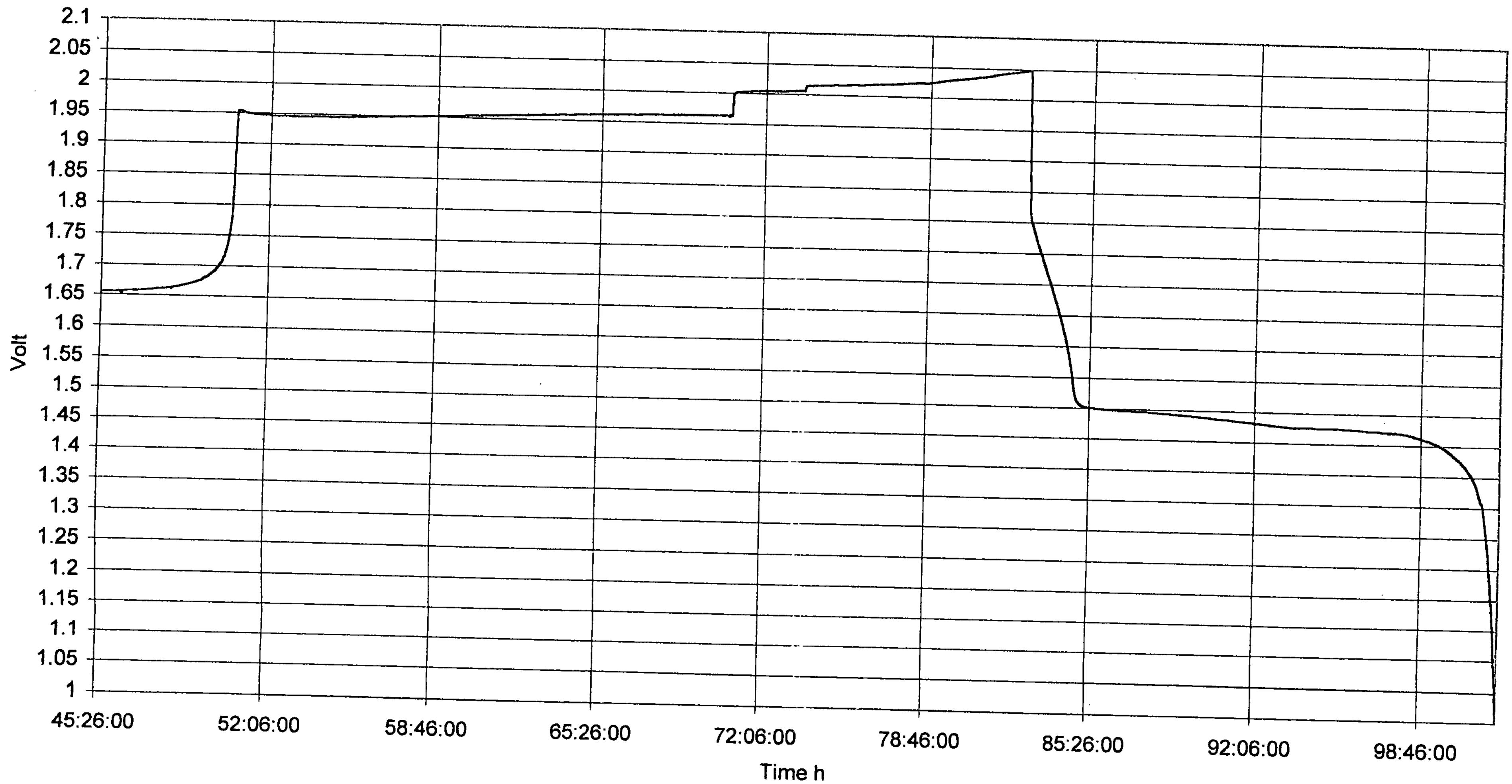


Fig. 11 Capacity b62-08
07/06/00

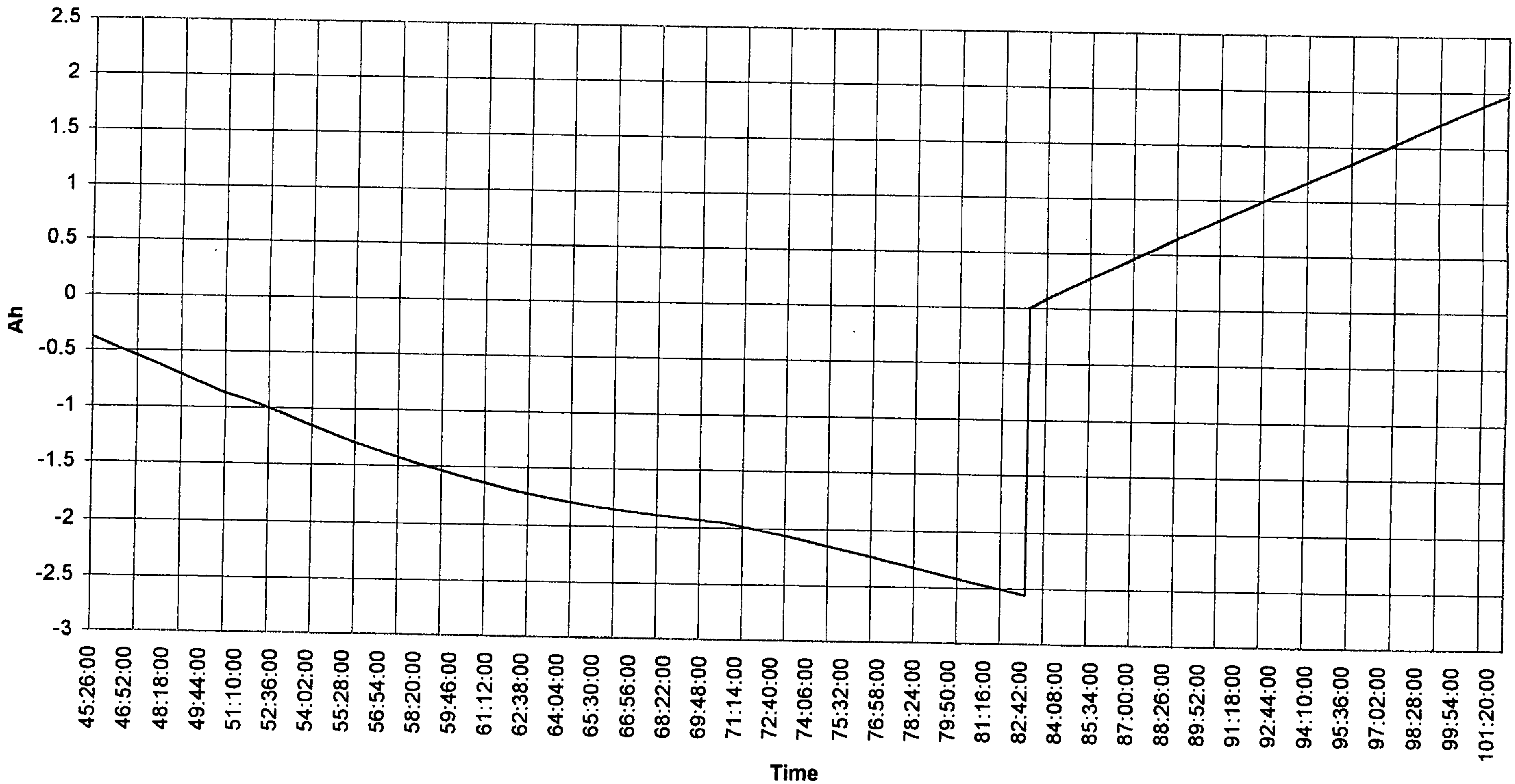
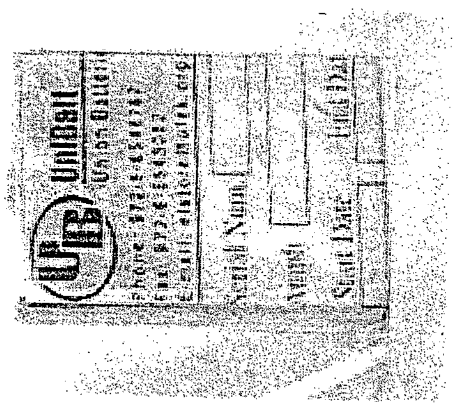


Fig 12



UniBatt

Test results
of Silver-Zink Unibatt cells

(Benchmark, safety, electronic system, talk test in cellular)

Participants:

Technion (Israel Technology Institute)

Dr. G. Frant – Electronic Laboratory (Chief of laboratory)

Dr. S. Ustilovsky – Structure analysis laboratory.

Unibatt Ltd

Dr. V. Kliatzkin	Director
Dr. L. Levinson	Chief Researcher.
V. Dmitrichenko	Technician
E. Rabinovich	Technician

Haifa, Kiryat-Yam
Israel
December 2003

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מכון המתכות הישראלי
ISRAEL INSTITUTE OF METALS

Laboratory: Metallurgical

Certificate No. B/68100

Date: December 8, 2003

Mechanical Testing of Silver-Zinc Battery

Client: UniBatt Ltd., 3 Narkis St., Kiriat-Yam 29500, Israel, By Vladimir Klazkin.

Subject of work: Batteries.

Time of execution: December 2003.

RESULTS

- See the attached pages -

מוסד הטכניון למחקר ופיתוח בע"מ * TECHNION RESEARCH & DEVELOPMENT FOUNDATION LTD.
חיפה
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חתימת מנהל המכון

Dr. O. Botstein
Head of Metallurgical Lab
חתימת ראש המעבדה

Dr. S. Ustilovsky
Inspector in Charge
חתימת המבצע

- This report refers only to tested material
- This report should be used only in its entirety

No responsibility is held for material more than 1 month after work completion

- דו"ח זה מתייחס רק לחומר שנבדק
- יש להשתמש בדו"ח זה במלואו בלבד

אחריות המכון לחומרים שנמסרו פוקעת בתום חודש מסיום העבודה

כתובת: קרית הטכניון, חיפה 32000, טל. 04-8294473-4, פקס: 04-8235103
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מוסד הטכניון למחקר ופיתוח בע"מ
TECHNION RESEARCH AND DEVELOPMENT FOUNDATION LTD.
מכון המתכות הישראלי
ISRAEL INSTITUTE OF METALS

1. Introduction

4 silver-zinc batteries of UniBatt ZS-5 type were brought by the client to the Metallurgical Lab of the Israel Institute of Metals. According to the client the batteries have 5 A-hours capacity, 1.5 V medium voltage and 11 cc volume.

We were asked to perform the following mechanical tests:

- Crush test
- Impact test
- Nail piercing
- Drop test
- Vibration proof test

2. Results of the tests

The crush test was performed using an Instron 4400R-type testing machine. The battery was loaded between 2 parallel plates with 13 kN load.

The impact test was performed using a Wolpert-type impact testing machine. The 9.1 kg hammer, which had 7.9 mm edge radius (15.8 mm diameter) was dropped from 61 cm height and stroke the tested battery supported by a flat anvil.

The nail piercing test was performed with a hard nail, which pierced the battery 5 mm deep.

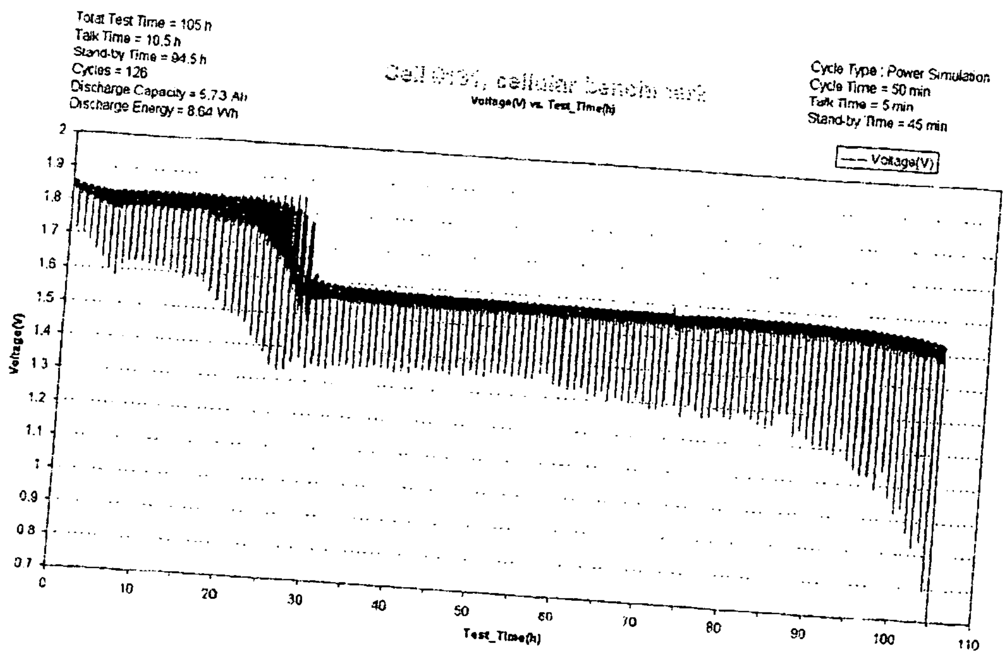
The drop proof test was carried out by dropping the battery from the height of 90 cm onto concrete floor 3 times for bottom, side and head orientation.

The vibration test was performed using an Instron 8800R-testing machine. The battery was subjected to vibration with amplitude of 1.6 mm in 3 directions in the frequency range from 10 Hz to 55 Hz.

The test results are summarized in Table 1.

UniBatt

Fig.1 - Cellular Telephone Bench Mark



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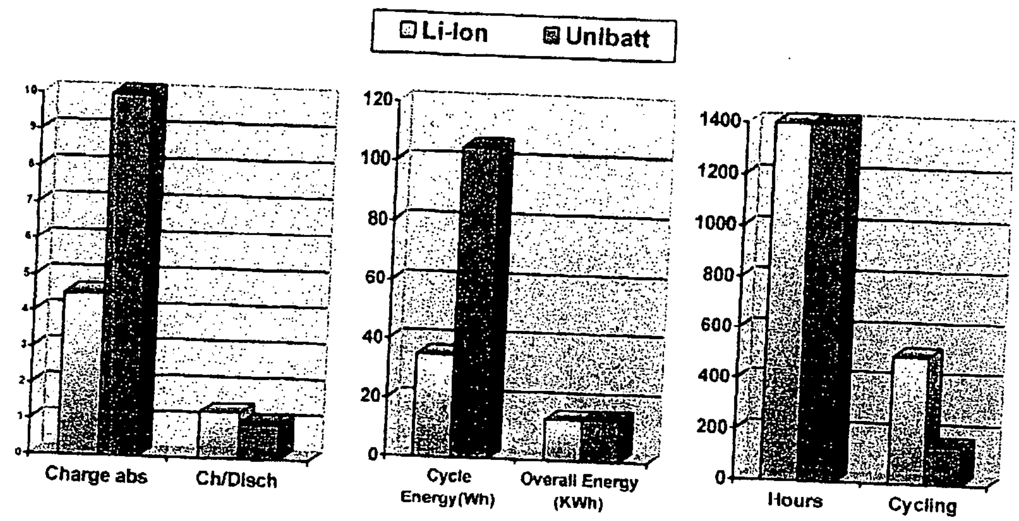
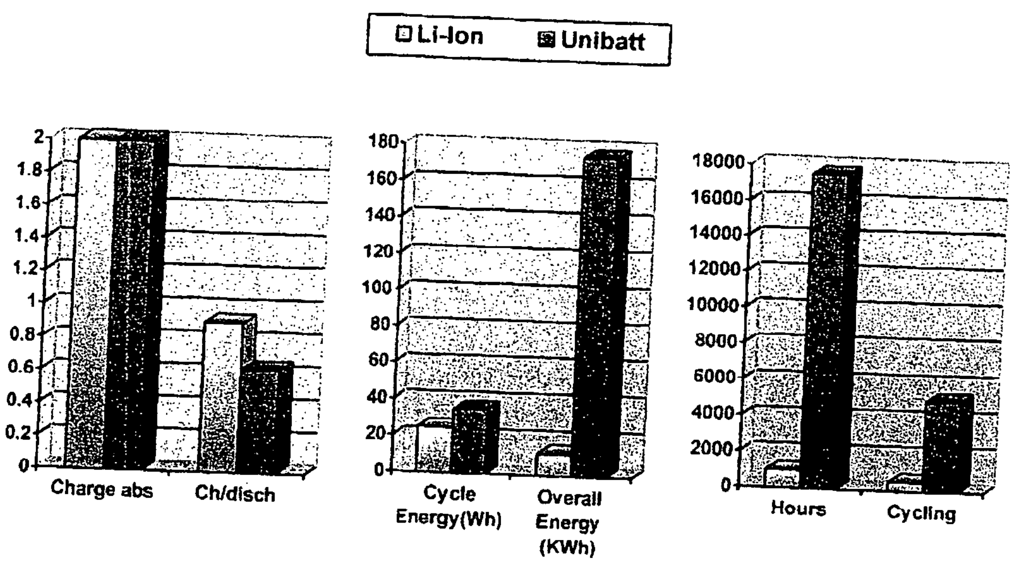
UniBatt

Fig.3 Li – Ion – Unibatt Parameters comparison.

CELLULAR, Deep Charge



CELLULAR, Fast charge



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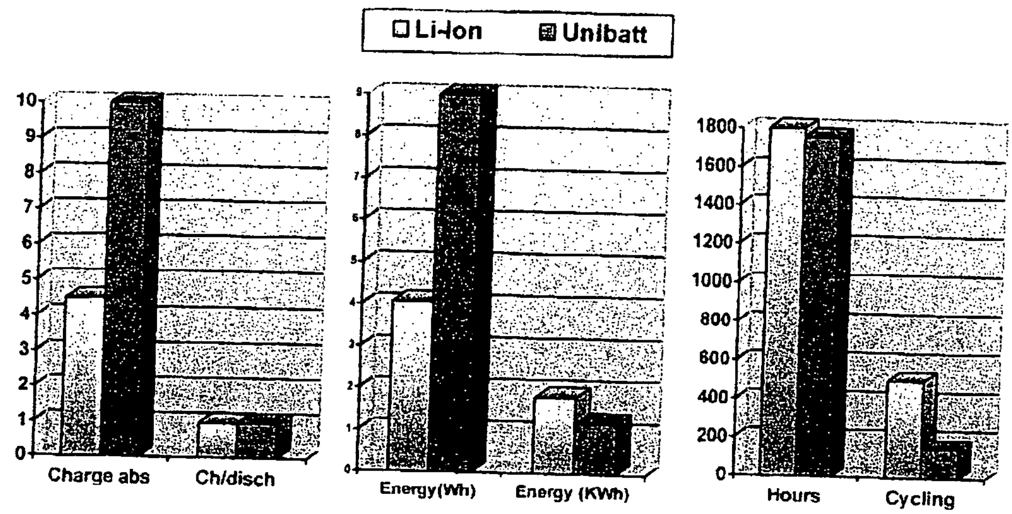
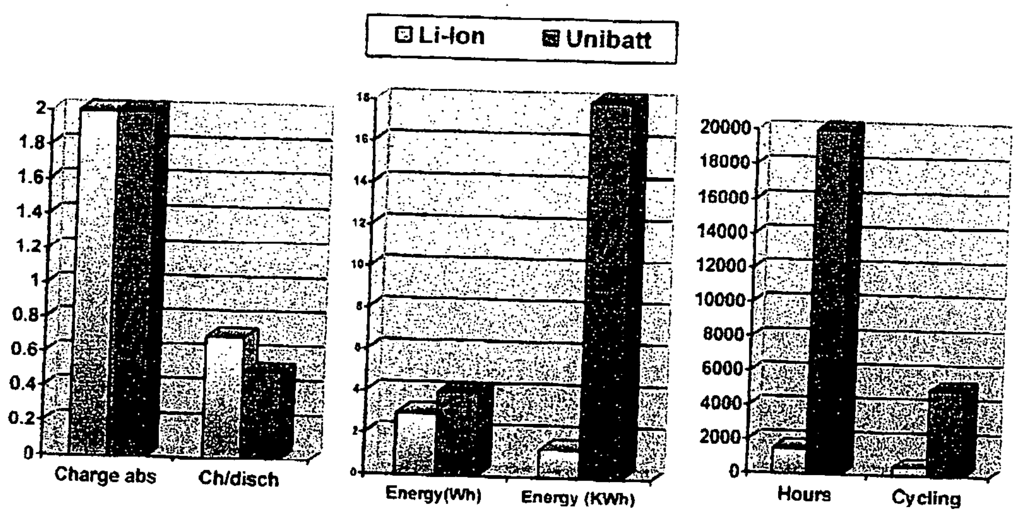
UniBatt

LAPTOP, Deep Charge



LAPTOP, Fast Charge



3. DC/DC boost converter.

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